6. PV Applications. 6.4 PV Applications without a Centralized Grid

PERFORMANCE OF A PHOTOVOLTAIC PUMPING SYSTEM

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The photovoltaic pumping systems have proved through the years that is an effective way to supply water in rural and agricultural areas. The electronics for instrument control, such the Power Conditioning equipments, has contributed to the efficiency of these systems. The use of conditioning power devices have the function of tracking the maximun power point to provide as much energy as possible to the motor pump.

However a bad conditioning between the pump and the photovoltaic generator can make part of the installed power unusable. To meet the hydraulic needs, a drop of the overall performance (defined by the ratio between the potential energy and the solar energy received) means that it is necessary to take up more surface for the generator and less for the farming activities

In this work, a PV pumping system was installed in a building at the University of Malaga. The system simulates a conventional PV pumping system which in real conditions would supply a small agricultural installation.

In the installation under examination it has been find that it is possible to improve the overall efficiency of the system obtaining a similar volume of water with a less photovoltaic modules installed. It can be concluded that the optimal performance allow a lower investment cost. Also a lower surface for the PV generator is a benefit.

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EXPLANATORY PAGES

The benefits of the control electronics is well known for all photovoltaic applications, particularly the Maximum Power Point-Tracking systems have significantly improved the performance of PV pumping systems.

The photovoltaic pumping systems have proved through the years that they are an effective way to supply water in rural and agricultural areas (1). For these applications, an optimal conditioning between the PV generator and the pump is important, since a bad conditioning between them drops the overall efficiency of the system.

Due to the energy density available, the PV generators can take up a valuable surface in terms of farming business. It is here that a overall performance (defined by the ratio between the potential energy and the solar energy received) used to its highest efficiency is what is most important.

For this research it was installed a PV pumping system in a building at the University of Malaga. The system simulates a conventional PV pumping system which in real conditions would supply a small agricultural installation, as shown in the figure 1. The pump can operate in a wide range of voltage between 30 and 300 V. This characteristic has allowed us to work with different number of PV modules connected in series.

Measures have been taken during the days with different installed power and in days with similar irradiances. The following volumes of water were obtained:

Table 1 - Volumes of water pumped within the varying power.

	31 Oct	6 Nov	11 Nov
Power installed [Wp]	720	480	240
Water pumped [m3]	24	20	10

A clamp Ampmeter and a multimeter were used to determinate the operating point of the curve I-V. And for the flow a flowmeter was set in the loading pipe.

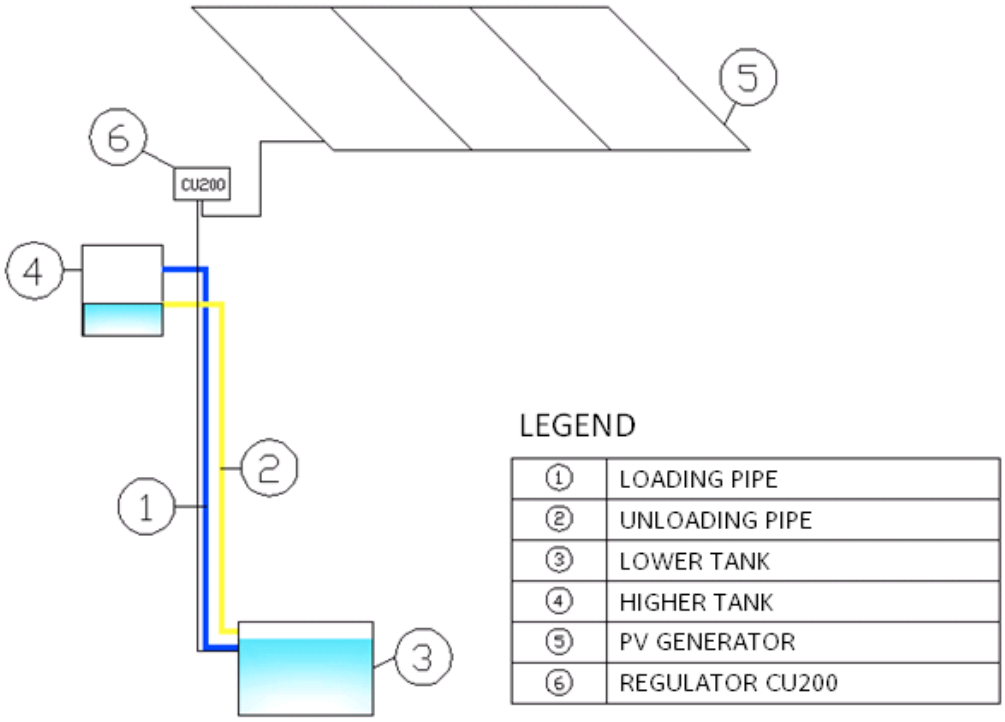

Figure 1 - System diagram.

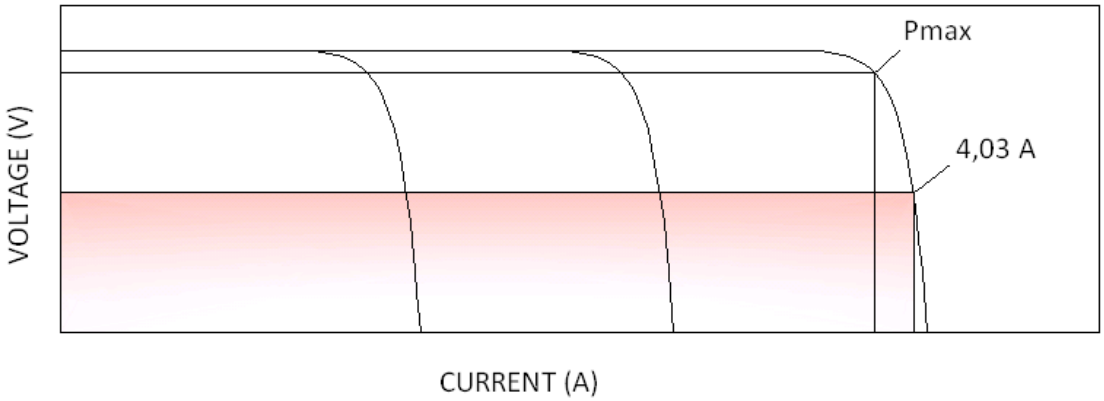

Figure 2 - Maximum point of work with 3 modules connected.

The radiation in the surfaceof the PV generator and the potential energy have been calculated day by day. The results are shown in table 2.

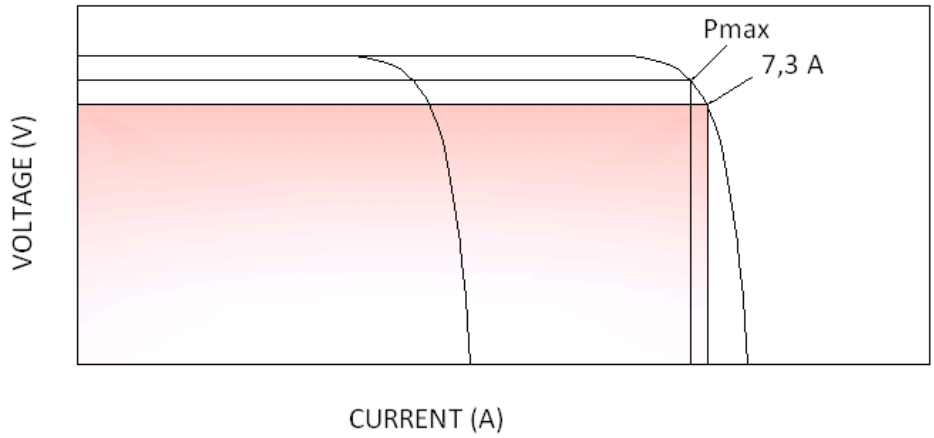

Figure 3 - Maximum point of work with 2 modules connected.

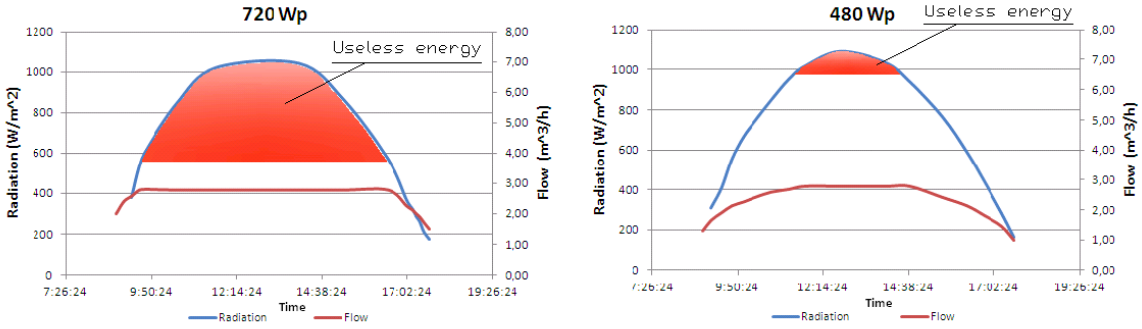

Figure 4 - Useless energy to different power set.

Table 2 - Varying performances of the installation.

	720Wp	480Wp	240Wp
E_r[Wh]	11731	7820	3910
E_p[Wh]	908	757	378
Performance	7,7%	9,7%	9,7%

The results let conclude that it is possible to work a similar amount of water using less PV modules and taking up less surface due to the increase of the overall performance of the system.

The amount of water might be even higher with two modules connected than with three if a PV modules tracking along its North-South axis is added (2). An alternative option may be choosing a more appropriate pump for the power of the PV generator.

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